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SUMMARY

The general results of the noise impact study are summarized as follows:

1. Truck haulage noise is at worst a relatively minor problem at all sites with site access as given in the Technical Report on the Transportation Assessment.

2. All sites except Site F would exceed the Ministry of Environment 55 db Leq criterion for noise from landfill sites if not mitigated.

3. A mitigation strategy has been developed involving building up a 15m berm of landfill during the initial phases of the site development, and working behind this berm thereafter. This will result in approximately one year above the MOE criterion for any of the affected residences, then compliance with MOE's standard thereafter.

4. After the mitigation, the worst-case sound experienced by neighbours surrounding the sites relative to the MOE criterion will be as follows:

   Site A - All residences mitigatable at or below, MOE 55 dB Leq criterion.
   Site B - 14 homes well above MOE criterion
   Site C - 9 homes well above MOE criterion
   Site D - 7 homes well above MOE criterion
   Site E - 1 home well above MOE criterion
   Site F - Meets MOE criterion without mitigation

5. A secondary level of comparison, residents exposed to sound between 50 and 55 dB Leq in the "worst-case", does not alter the impact assessment comparisons.

6. Landfilling operations at Site F will impact activities in the Bayview Park. However, mitigation in the form of moving the noise sensitive facilities to another location is suggested.

7. Given the above and incorporating the suggested mitigation for Bayview Park at Site F, the Site Plan Areas are ranked acoustically in the following order:

1. Site F
2. Site A
3. Site E
4. Site D
5. Site B
6. Site C

1.0 INTRODUCTION

The landfill operations have been modelled acoustically. The calculation has been checked by comparing its results with the measurements taken to support the report prepared for the extension of the present landfill operations in Burlington. The model was applied to each Site Plan Area, mainly to allow a comparison between sites. However, a preliminary assessment of the absolute impact of each site has also been undertaken.

Two migitation possibilities are also incorporated in the evaluation procedure, as only one of the sites could meet the MOE's criterion without mitigation. Except for two sites, the mitigation requirements are not onerous. This analysis assumes the Site Plan Areas as laid out in the Technical Report on the conceptual designs (Hydrogeologic-Hydrologic Assessment and Conceptual Design). At the level of detail for this comparison of sites, incidental sounds such as tail gate banging and back-up horns on trucks have not been incorporated.

2.0 NOISE MODEL

We have assumed 4 to 5 heavy diesel powered tracked and wheeled vehicles operating continuously on the site through the day. Each of these machines cycles between 80 and 88 dB Leq at a distance of 15 metres (50'), giving an energy averaged sound level of about 85 dB Leq at 15 metres (50'). These machines, together with the disposal trucks, give us a net level of approximately 92 dB Leq at 15 metres (50'). Table 1 has been assembled on the basis of this sound source operating at grade (without berm), and elevated at the top of the final fill height. The distance noted is that between a residence and the location where the machines are actually operating, not the distance from the residence to the edge of the landfill site. In all cases, there always is at least a 100 meter buffer between the landfill operation and the nearest residence.

TABLE 1
SOUND LEVELS OF FILLING AND COVERING OPERATIONS
Receiver Height 1.5m - Neutral Weather Conditions - "Worst-Case" Scenario

Distance from Actual Operation	AVERAGE SOUND LEVEL (dB Leq)*							
	EXPOSED MACHINERY				MACHINERY BEHIND 3m BERM			
	at Grade		at 10-15m Height		at Grade		at 10-15m Height	
100m	68.5	(66.5)	74.5	(72.5)	63.5	(58.5)	69.5	(65.5
200m	60	(58)	65	(63)	55	(51)	60	(56)
300m	55	(53)	59	(57)	50	(46)	54	(50)
400m	52	(50)	57	(55)	47	(43)	52	(48)
500m	49	(47)	55	(53)	44	(40)	50	(46)
800m	45	(43)	50	(48)	40	(36)	45	(41)

MOE Criterion - 55 dB Leq "Worst-Case"

*Leq refers to the hourly average "A" weighted sound energy.
( ) Figures represent the case of muffled vehicles.

Truck noise on the site is relatively insignificant compared to the noise of the covering activities, especially as it applies to the worst case. It is anticipated that typically three heavy trucks will be in the area of the filling operation at any one time. The major impact of the noise of the trucks comes on entering or leaving the site, if they pass close to nearby houses and little traffic on the access roads.

3.0 POSSIBLE MITIGATION METHODS

From Table 1, the unmitigated sound for the homes within 450-500m of the fill area, will eventually exceed the sound level criterion set out by the Ministry of the Environment (MOE). Homes within 300m of operations will exceed the 55 dB Leq level as soon as the operation commences at that distance if there are no intervening berms. In fact, at the outset of operation, 3-4 metre berms of fill material are erected along the buffer, to be used later for cover material; therefore, the first noise heard comes from moving the cover material to the buffer areas.

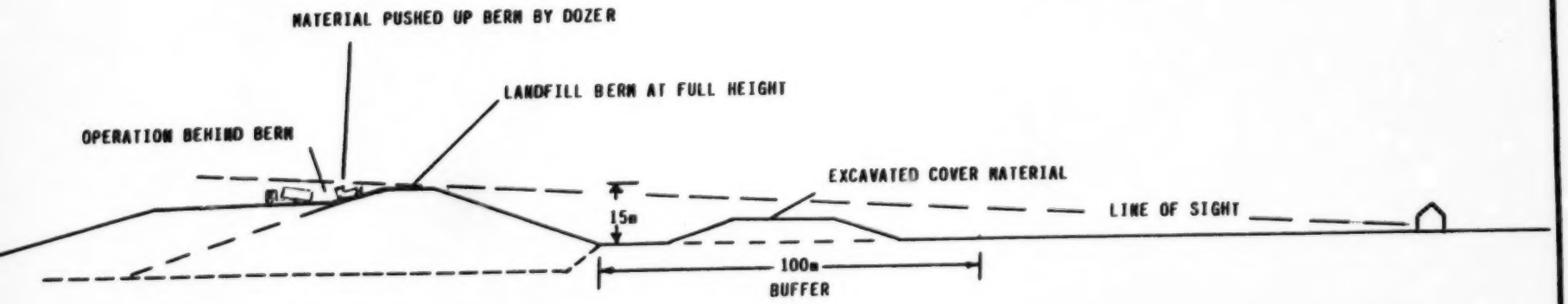
There are two advisable noise mitigation measures. The first is to purchase good muffling for the "on site" equipment and apply and maintain this equipment. This measure does not have dramatic effects on the noise levels at close range; however, it does change the character of the sound by removing some of the low frequency throb and the higher frequencies that remain are easier to attenuate with barriers and distance. This measure is assumed in the parenthesized figures in Table 1. As a result of this, exposed covering activities will meet the MOE criterion for homes beyond 400m, and the shielded activities will meet MOE's criterion as close as 250m away.

The second method of mitigation involves a tradeoff. The process suggested is to build up to the full 15m (50') height, a mound or berm of fill material along the edge of the active area as quickly as possible, and thereafter work behind this barrier (see Figure 1). The trade-off is that during the erection of the mound or berm of fill, the sound levels will be quite high for about a year in the areas affected. After this year, the activities will be mostly shielded behind the berm from the nearest neighbours.

It is estimated by the site design consultant that a 400m length of such berm can be built in a year. We are advised by the site design engineers, however, that the berm can only be cost effectively used if it starts on or near the headers (collection end) of the leachate collection system (See

Figure A9, B9, C9, D9, E9, F5 of the Hydrogeologic-Hydrologic Assessment and Conceptual Design Technical Report). Otherwise, the leachate collection system for most of the site would have to be installed before the berm could be started, instead of a small portion at a time, increasing start-up capital costs considerably.

If this form of mitigation is applied, the two left columns of Table 1 would apply to the initial year. Assuming shielding due to the berm, the two right columns would apply thereafter.



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ENG	DRW	CHK
JEC	JEC	

TITLE: SOUND MITIGATION BERM SECTION
PROJECT: HALTON LANDFILL
CLIENT: HALTON
DATE: 84/12/04
FIGURE: 1

4.0 ANALYSIS

The worst case analysis for on-site noise is an oversimplification. In fact, operations move around the site as filling proceeds, and there would be a variety of exposure to sound. The potential sites are so large, that the activities in one corner would be almost inaudible at homes across the other side of the site while the levels at the edge of the buffer when filling is closest to a nearby residence, are relatively high. The suggested mitigation measure--the "trade-off"--does not change the worst case while the berm is being built; it does, however, substantially reduce the noise impact thereafter. Table 2 indicates the differences in the noise levels, based upon the MOE criterion of 55 dB Leq (daytime), assuming extra muffling, and using the berm technique.

TABLE 2
EXCESS NOISE ABOVE MOE GUIDELINE (dB Leq)

Distance from Nearest Landfill Operations	During Building of Fill Berm dB Leq	After Berm Completed dB Leq
100m (across buffer)	17	10
200m	8	1
300m	2	0
400m	0	0

The criterion level set by the MOE is a compromise. It is somewhat higher than what is asked for in the case of other rural noise sources (see NPC 232-Guidelines for Noise Control in Rural Areas).

Therefore, to demonstrate the presence of noticeable impact rather than significant impact (i.e., it is anticipated that some of the residents would be somewhat annoyed by sound levels between 50 and 55 dB Leq), Table 3 applies assuming the berm is used, and using a lower criterion of 50 dB Leq, rather than 55 dB Leq.

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TABLE 3
EXCESS ABOVE 50 dB Leq CRITERION

Distance from Nearest Landfill Operations	During Building of Fill Berm or No Berm	After Berm Completed
100m	22	10.5
200m	13	6
300m	7	0
400m	5	0
500m	3	0
650m	0	0

Background sound levels are not a significant factor in the analysis, i.e., the MOE 55 dB Leq criterion is above the background sound levels of the homes; except at Site F where traffic noise from Highway No. 403 is already high enough to help cover up noise from the landfill operation, for homes to the south of the Highway.

5.0 HAULAGE ROUTES

Haulage route noise impact is determined by calculating the amount of increase in noise due to the haulage vehicles (trucks). One large truck produces approximately 10-13 times as much sound energy as a car. Most typical arterial roadways carry about 5% heavy truck traffic. Thus, for most of the roads, the total noise energy is about 1.7 X (the number of vehicles) X (the energy of one car).

The threshold for traffic noise impact is the point where the added energy of the landfill traffic equals the energy of the road (a 3 dB Leq impact), either under present traffic conditions, or at some projected date.

On a daily basis, where the total landfill truck traffic operates on a road with less than 5,000 AADT (Average Annual Daily Traffic), there will be a noise impact if there are noise sensitive land uses close enough to the road.

On an hourly basis, the equivalent figure for traffic volume is 7500 AADT vehicles. The impact may be slightly greater, since the peak hours (rush hours) of normal roadway traffic typically carry 20-25% of the total daily traffic, and the evening and night-time about another 20%.

Appendix A includes the calculations used as the basis of analysis for potential haulage route impacts.

6.0 RATINGS OF SITES

6.1 Site Plan Area A (Map 1)

6.1.1 Haulage

Assuming a northern entry point off Trafalgar (approximately 12,000 vehicles AADT), the only haulage noise impact is likely to be at the house immediately adjacent to the access point. All other routes have an impact of less than 3 dB Leq.

Trafalgar Road is sufficiently busy now (and is anticipated to become busier) to prevent a significant noise impact along this road. The increase in traffic when future Highway No. 403 is constructed will further mask the sound of haulage noise of trucks using this roadway.

6.1.2 Operations

Site A would have a significant noise impact on the residences immediately to the south across Burnhamthorpe Road and on those to the east and west along the same road. The Conceptual Plan for this site calls for the leachate system to be installed across the south of the site, and therefore the fill/berm mitigation technique is viable here, in principle, to reduce this noise impact. There are eight homes in the 200-300m distance range (mostly 300m) who will exceed the MOE criterion by 3-8 dB Leq for about one year at each location. Beyond this time, the site can be made to function within the MOE guideline. This Site is considered viable from a noise point of view. After the berm is built, eight residences will fall above 50 dBA Leq.

6.2 Site Plan Area B (Map 2)

6.2.1 Haulage

Trafalgar Road is sufficiently busy now (and is anticipated to become busier) to prevent a significant noise impact along this road. The increase in traffic when future Highway No. 403 is constructed will further mask the sound of haulage noise of trucks using this roadway.

6.2.2 Operations

The Conceptual Plan for this Site calls for the leachate system to be installed in such a way that it will effectively drain away from the area containing the residential neighbours, and thus prevent the berm to be constructed in the fashion outlined above. Therefore, little mitigation of the noise impact is possible using the berm technique, and the 14 homes within 300m will receive substantial excess noise levels of 5-10 dB Leq above the MOE criterion over a protracted period of time.

This site, therefore, cannot be recommended from a noise point of view.

6.3 Site Plan Area C (Map 3)

The site comments regarding Site B apply almost verbatim to Site C, except that a total of nine dwellings will consistently receive noise levels of more than 55 dB Leq.

6.4 Site Plan Area D (Map 4)

6.4.1 Haulage

Highway 25 now carries approximately 8,000 vehicles AADT and is projected to increase to about 12,000 vehicles per day when Highway 403 is construct-

Lower Base Line
Beaverdam Road
Fourth Line Road
Kings' Highway No. 5
Dundas Street
Sixth Line
Trafalgar Road
Eighth Line
Upper Middle Road
SITE
AREA

MAP 1

LEGEND

EXTENT OF WORST CASE NOISE CONTOURS

- 55 dB Hourly Leq Prior to Mitigation
- 55 dB* Hourly Leq Mitigation in Place
- 50 dB Hourly Leq Prior to Mitigation
- 50 dB* Hourly Leq Mitigation in Place
- Site Plan Area
- No Mitigation

Map Information Compiled By
Barman, Coulter, Swallow Associates

Study Area

PHASE 2, STAGE 2C
SELECTION OF PREFERRED SITE

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT OF HALTON'S SOLID WASTE MANAGEMENT SYSTEM

Walker Wright Young
Associates Limited

Lower Base Line
Burnhamthorpe Road
Fourth Line Road
SITE
B
55 dB*
50 dB*
Kings Highway No. 5
Dundas Street
Sixth Line
Trafalgar Road
Eighth Line
Upper Middle Road

MAP 2

LEGEND

EXTENT OF WORST CASE NOISE CONTOURS

- 55 dB Hourly Leq Prior to Mitigation
- 55 dB* Hourly Leq Mitigation in Place
- 50 dB Hourly Leq Prior to Mitigation
- 50 dB* Hourly Leq Mitigation in Place
- Site Plan Area
- * No Mitigation

Map Information Compiled By
Barman, Coulter, Swallow Associates

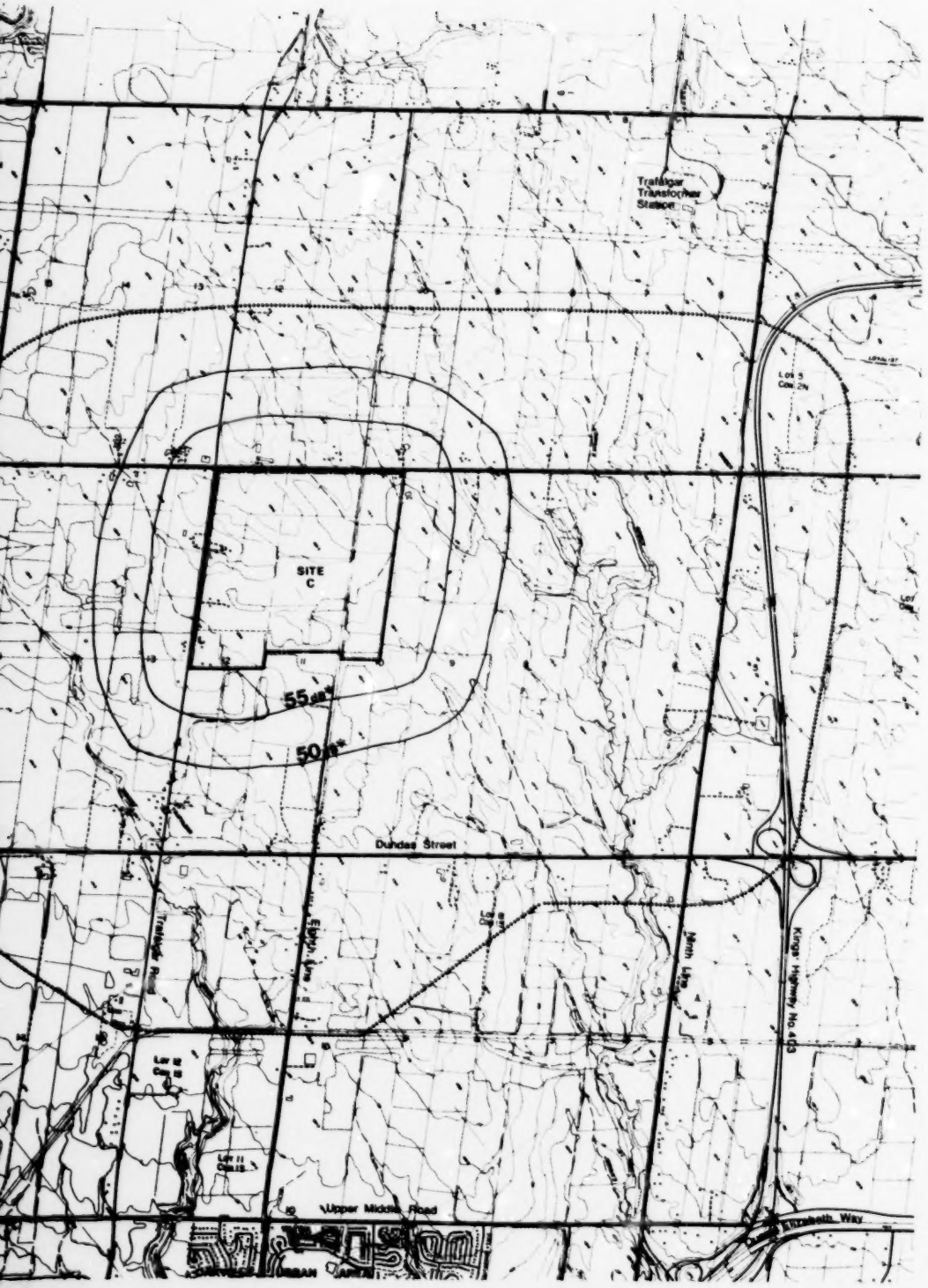
..... Study Area

PHASE 2, STAGE 2C
SELECTION OF PREFERRED SITE

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT OF HALTON'S SOLID WASTE MANAGEMENT SYSTEM

Walker Wright Young
Associates Limited

Lower Base Line
Lot 15
Con 2N
Lot 20
Con 2N
Burnhamthorpe Road
Fourth Line Road
SITE
C
55 dBA
50 dBA
Kings' Highway No. 5
Dundas Street
Sixth Line
Trafalgar Road
Eighth Line
Lot 11
Con 1S
Upper Middle Road



MAP 3

LEGEND

EXTENT OF WORST CASE NOISE CONTOURS

- 55 dB Hourly Leq Prior to Mitigation
- 55 dB* Hourly Leq Mitigation in Place
- 50 dB Hourly Leq Prior to Mitigation
- 50 dB* Hourly Leq Mitigation in Place
- Site Plan Area
- No Mitigation

Map Information Compiled By:
Barman, Coulter, Swallow Associates

Study Area

PHASE 2, STAGE 2C
SELECTION OF PREFERRED SITE

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT OF HALTON'S SOLID WASTE MANAGEMENT SYSTEM

Walker Wright Young Associates Limited

ed and linked to it. This is sufficient traffic volumes that the haulage noise along the route related to landfilling at this Site will not exceed our threshold criterion for traffic noise impact, even on the hourly basis.

6.4.2 Operations

The Conceptual Plan for Site D calls for the leachate system to be installed in a location to allow the berm technique to be used, such that the noise can be largely mitigated for the homes most affected, particularly along the western boundary. Including one home to the southeast of the Site, there are ten homes which would have an impact over the MOE criteria for approximately one year; thereafter, the levels of seven homes would still fall slightly above this criterion. (This Site is somewhat worse than Site A and E in terms of noise impact.) After the berm mitigation is completed, a total of 15 residences will be above 50 dB Leq during the daytime, in the "worst-case".

6.5 Site Plan Area E (Map 4)

6.5.1 Haulage

Britannia Road is virtually an unoccupied stretch between Highway No. 25 and Tremaine Road, and therefore there is little haulage noise problem until the trucks turn onto Tremaine Road. At that point, the two farms flanking the road will show a small noise level impact. The setback of these homes is large (100m), however, such that a daytime Leq from traffic is going to be 50 dB Leq at the houses. Relative to the noise level impact from the on-site equipment at the nearest neighbours, this is a relatively minor impact.

6.5.2 Operations

Mitigation for the homes to the south and west is possible, such that five homes will experience noise levels exceeding the MOE criterion for about

one year. Beyond this time, the site can be made to function within the MOE guideline. To the north there is one home which cannot be mitigated in this manner. (This site then rates somewhat poorer than Site A in acoustical terms.) After mitigation, a total of eight residences will be above 50 dB Leq when landfilling is closest to them.

6.6 Site Plan Area F (Map 5)

6.6.1 Haulage

The material is to be brought to the Site along the North Service Road, adjacent to Highway No. 403. The noise of the highway is such that there will be no significant haulage noise impact along the North Service Road.

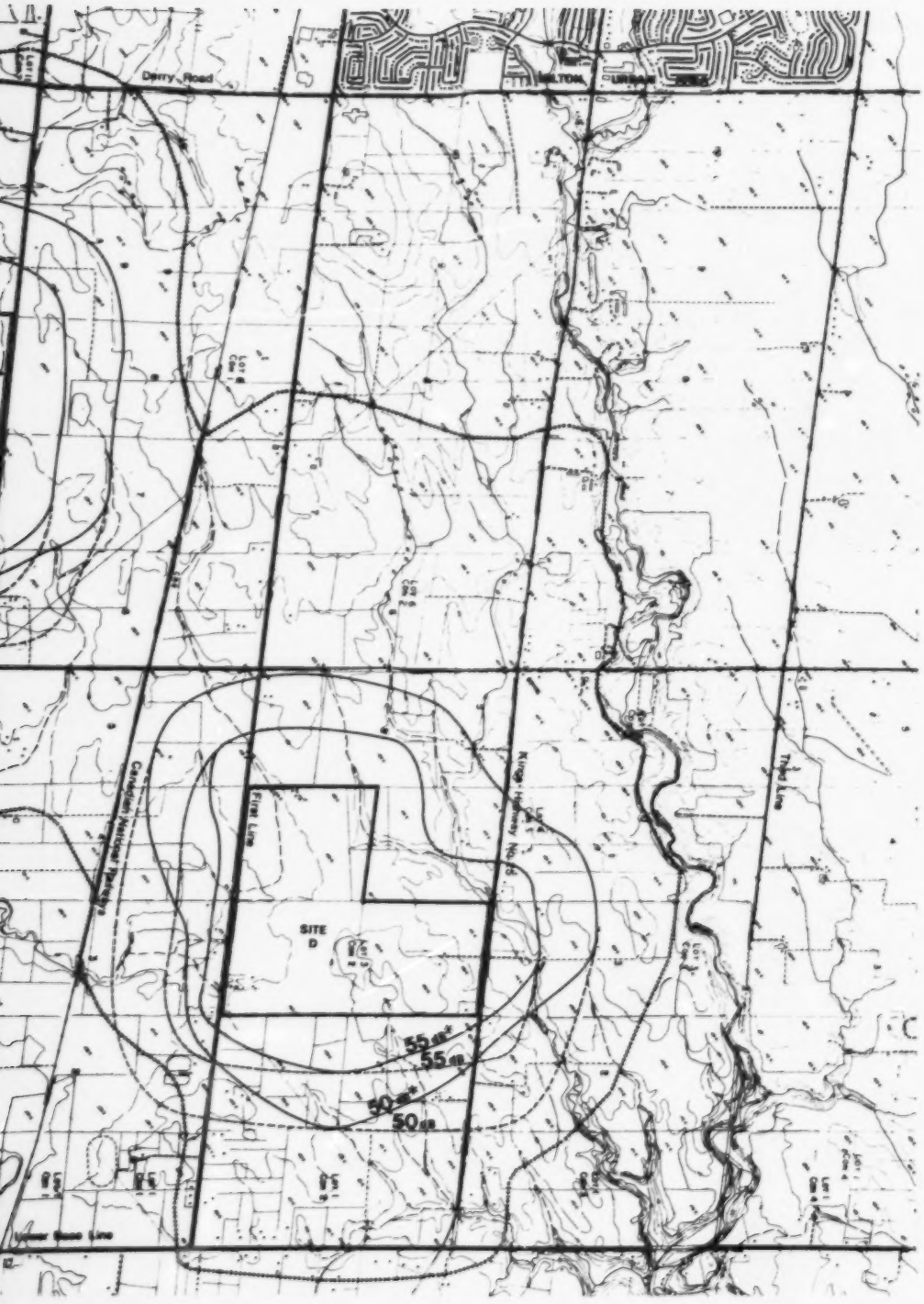
6.6.2 Operations

For the homes to the south of the Site and of Highway No. 403 , the average sound levels from Highway No. 403 and the CN Rail line are as high as would be experienced from the landfill operation. This applies to all of south Burlington.

To the north of the Site, the sound which is not mitigated would carry to the homes approximately 400m away from the northern tongue of the fill area. When this area is filled, these homes will be at the MOE 55 dBA noise criterion, provided mufflers are used on the equipment. The number of residences above 50 dBA Leq, when filling is closest to the homes, is five.

The existing Bayview Park will be heavily impacted by noise for several years with levels reaching 60-63 dBA Leq. Mitigation techniques suggested for Sites A, D, and E are not likely to be possible at this location. However, there is a distinction here in terms of the type of land use adjacent to the Site, and there will not be a need for the berm/fill mitigation measures to meet the MOE criterion for residences. Mitigation of the impact on Bayview Park might best be handled by providing similar facilities elsewhere. As such, Site F would rank as the lowest noise impact of all the Site Plan Areas.

Derry Road
SITE E
55 dBA
55 dB
50 dBA
50 dB
Britannia Road
Bell School Line
Trafalgar Road
Canadian National Railway
First Line
SITE D
55 dBA
55 dB
50 dBA
50 dB
Lower Base Line



MAP 4

LEGEND

EXTENT OF WORST CASE NOISE CONTOURS

- 55 dB Hourly Leq Prior to Mitigation
- 55 dB* Hourly Leq Mitigation in Place
- 50 dB Hourly Leq Prior to Mitigation
- 50 dB* Hourly Leq Mitigation in Place
- Site Plan Area
- No Mitigation

Map Information Compiled By:
Berman, Coulter, Swallow Associates

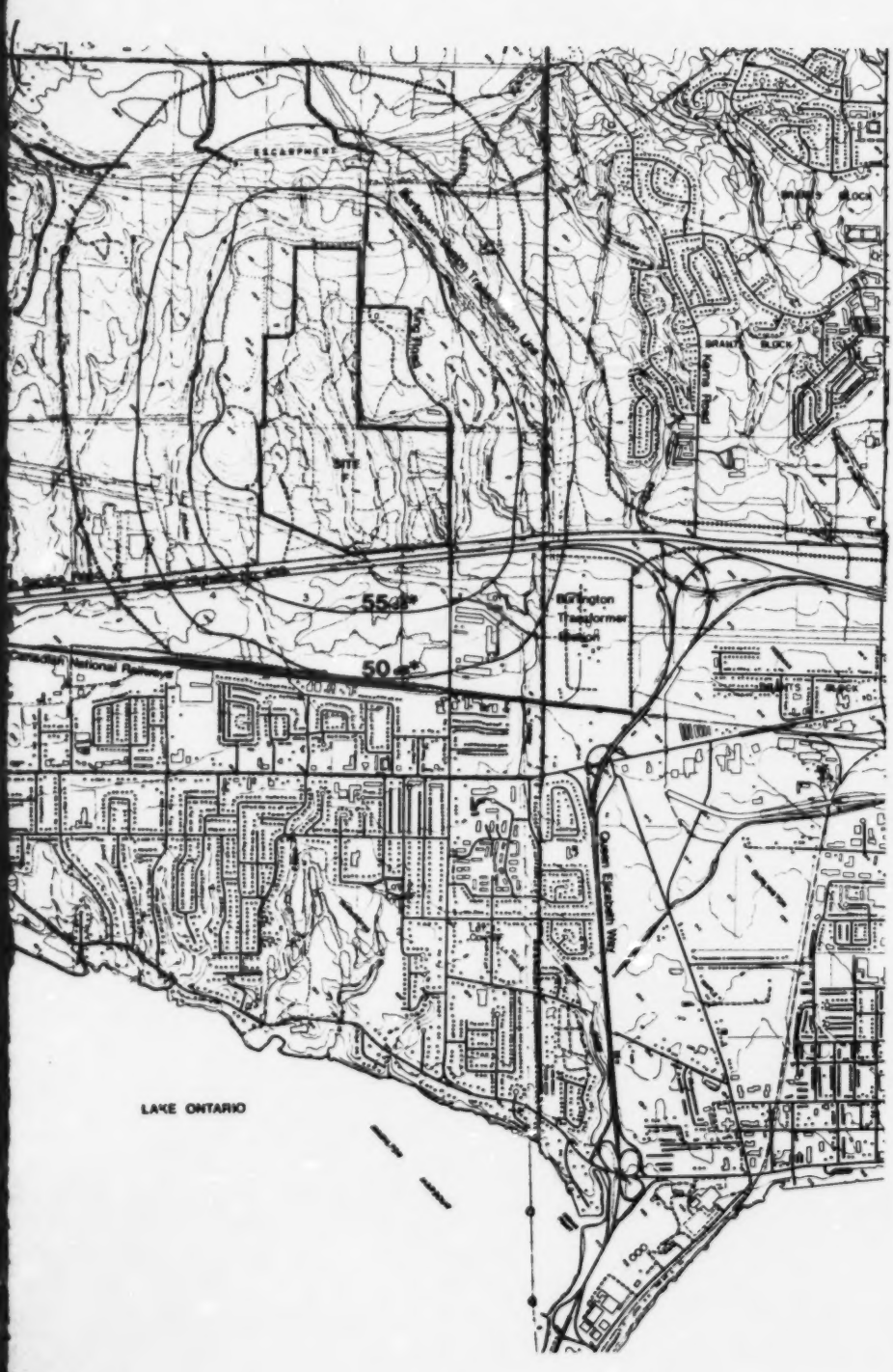
Study Area

PHASE 2, STAGE 2C
SELECTION OF PREFERRED SITE

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT OF HALTON'S SOLID WASTE MANAGEMENT SYSTEM

Walker Wright Young
Associates Limited

ESCARPMENT
Burlington (East) Transformer Station
Waterdown Road
SITE
F
North Service Road
Highway No. 403
55 dBA
50 dBA
Canadian National Railways
Burlington Transformer Station
Queen Elizabeth Way
LAKE ONTARIO
1000



MAP 5

LEGEND

EXTENT OF WORST CASE NOISE CONTOURS

- 55 dB Hourly Leq Prior to Mitigation
- 55 dB* Hourly Leq Mitigation in Place
- 50 dB Hourly Leq Prior to Mitigation
- 50 dB* Hourly Leq Mitigation in Place
- Site Plan Area
- No Mitigation

Map Information Compiled By:
Barman, Coulter, Swallow Associates

Study Area

PHASE 2, STAGE 2C
SELECTION OF PREFERRED SITE

ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT OF HALTON'S SOLID WASTE MANAGEMENT SYSTEM

Walker Wright Young
Associates Limited

7.0 CONCLUSIONS

It will be difficult to achieve acceptable sound levels for Site Plan Areas B and C, assuming the conceptual design plans as proposed. The other sites are viable acoustically. Based on the number of homes impacted and the extent of the impact, the sites are ranked acoustically as follows:

SITE PLAN AREA RANKING REGARDING NOISE

Site	A	B	C	D	E	F
	2	6	5	4	3	1

APPENDIX "A"

Haulage Noise Criterion Model

Site Traffic

Approximately 250 Heavy Vehicles/day
300 Light Vehicles/day

In terms of noise, 1 heavy vehicle is equivalent to 13 light vehicles.

Vehicles pass any one point on the route twice; once approaching and once leaving the site.

Therefore, total amount of sound energy per day is equivalent to

$$2 \times (13 \times 250 + 300)$$

= 710 light vehicle passbys per 12 hour day

For comparison to traffic volumes on ordinary roads, a typical arterial road has traffic made up of 95% light vehicles, and 5% heavy trucks (Dump Truck size and larger in this model)

To produce the same noise as the Haulage Vehicles over a 12 hour period, a road way would carry

$$\frac{7100}{0.95 + 13 \times .05} = 4440 \text{ vehicles (including the 5\% trucks)}$$

Most arterial roads carry 80% of their traffic during the 12 hour daytime. Thus a road carrying 4440 vehicles in 12 hours of daytime would carry 4440 ÷ 0.8 = approximately 5600 vehicles in 24 hours. This 24 hour figure is generally available as the AADT (Average Annual Daily Traffic) of a roadway.

The figures for comparing haulage noise to regular traffic noise are based on averages over a 12 hour day. If we look at only the quietest daytime hours of normal road traffic in mid morning and mid afternoon, the amount of normal traffic required to equal the haulage traffic noise is found on roads with AADT values of 7500 vehicles per day.

In general, significant haulage route noise impact starts when the haulage noise energy equals the regular roadway noise energy. This is equivalent to causing a 3 dB increase in sound level. This assumes that the affected area is close enough to the roadway for roadway noise to be significant in the first place.

Changes in traffic volumes by up to 25% have only a 1 dB effect on the estimates, thus, the analysis is quite insensitive to volume estimates.